

Altair

Subject:

7th Combined Science

Class: Matter, Atoms
and Elements

Date: September 24th
2011



Teacher's notes

Objectives

Vocabulary

Link and Learn

Prepared by

What are things made of?

How can physical
properties be used to
identify matter?

Matter and Physical Properties

- **Matter** is anything that has mass and takes up space.
- Objects made of matter can be very different from each other.
- Each object has its own set of characteristics, or *properties*.
- **Physical Properties** are characteristics of a substance that can be observed or measured without changing the substance into something else.

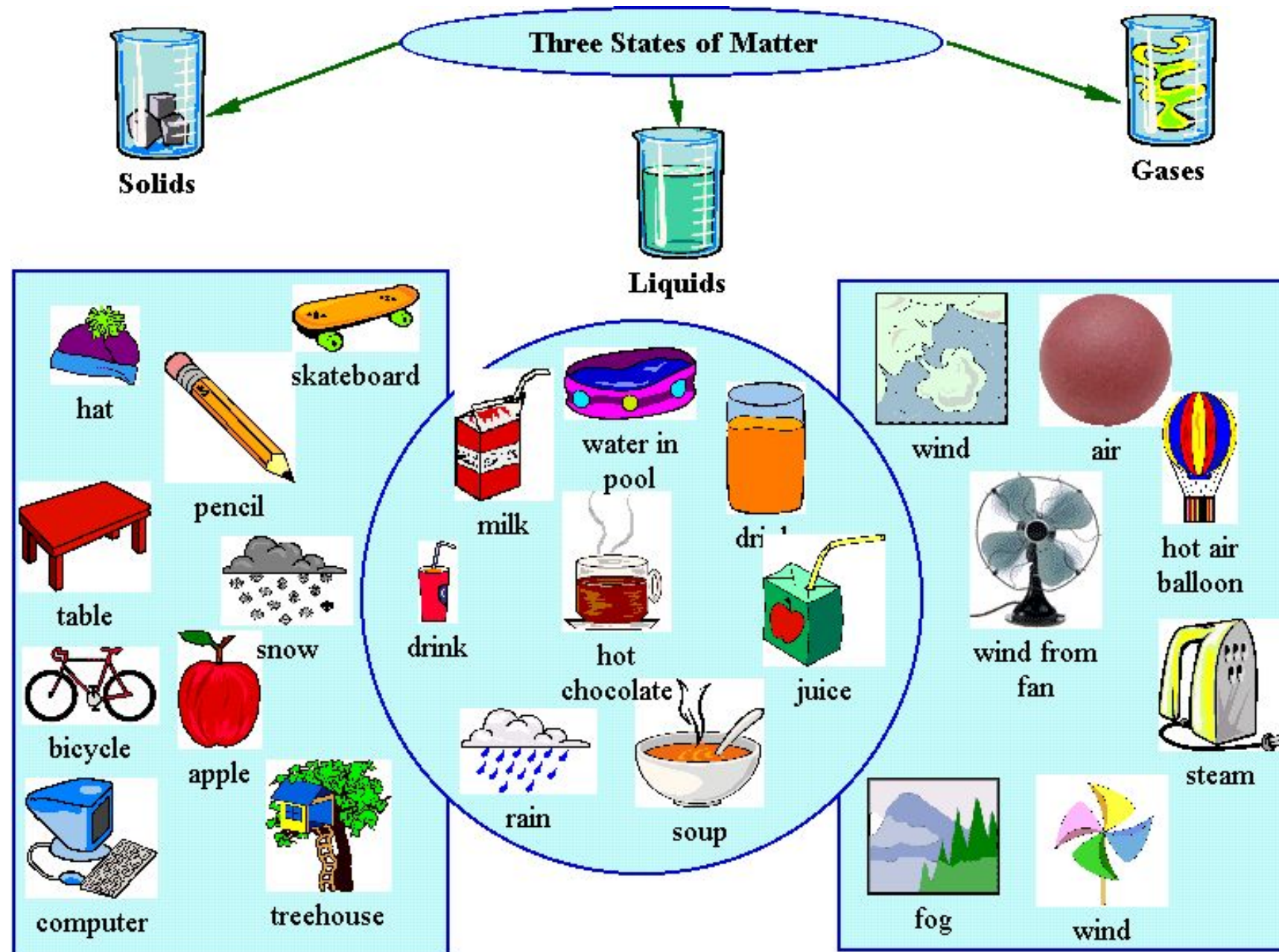
Can you name a few?



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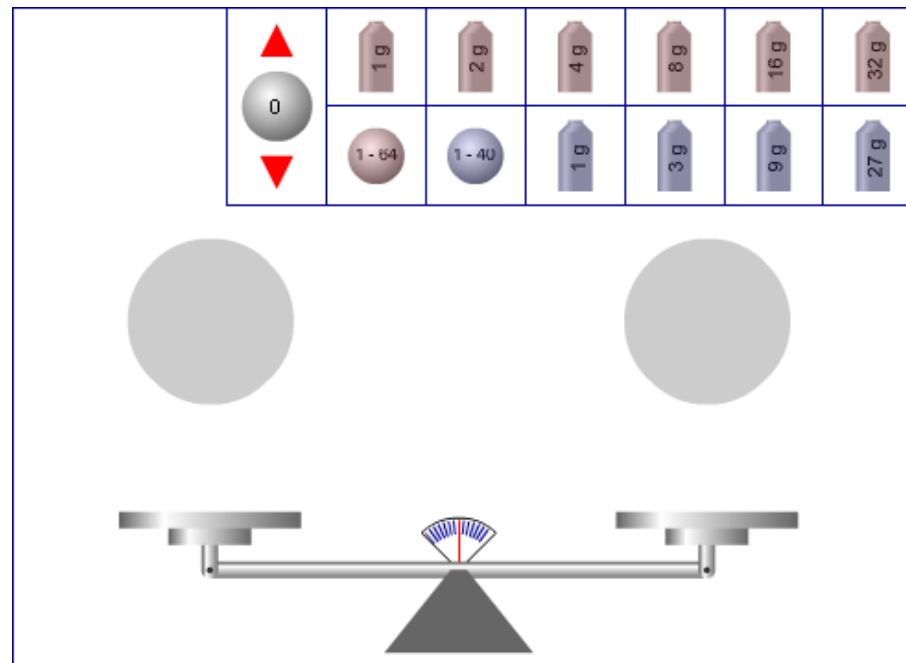
Minerals in our Environment

<http://goo.gl/Exf4S>

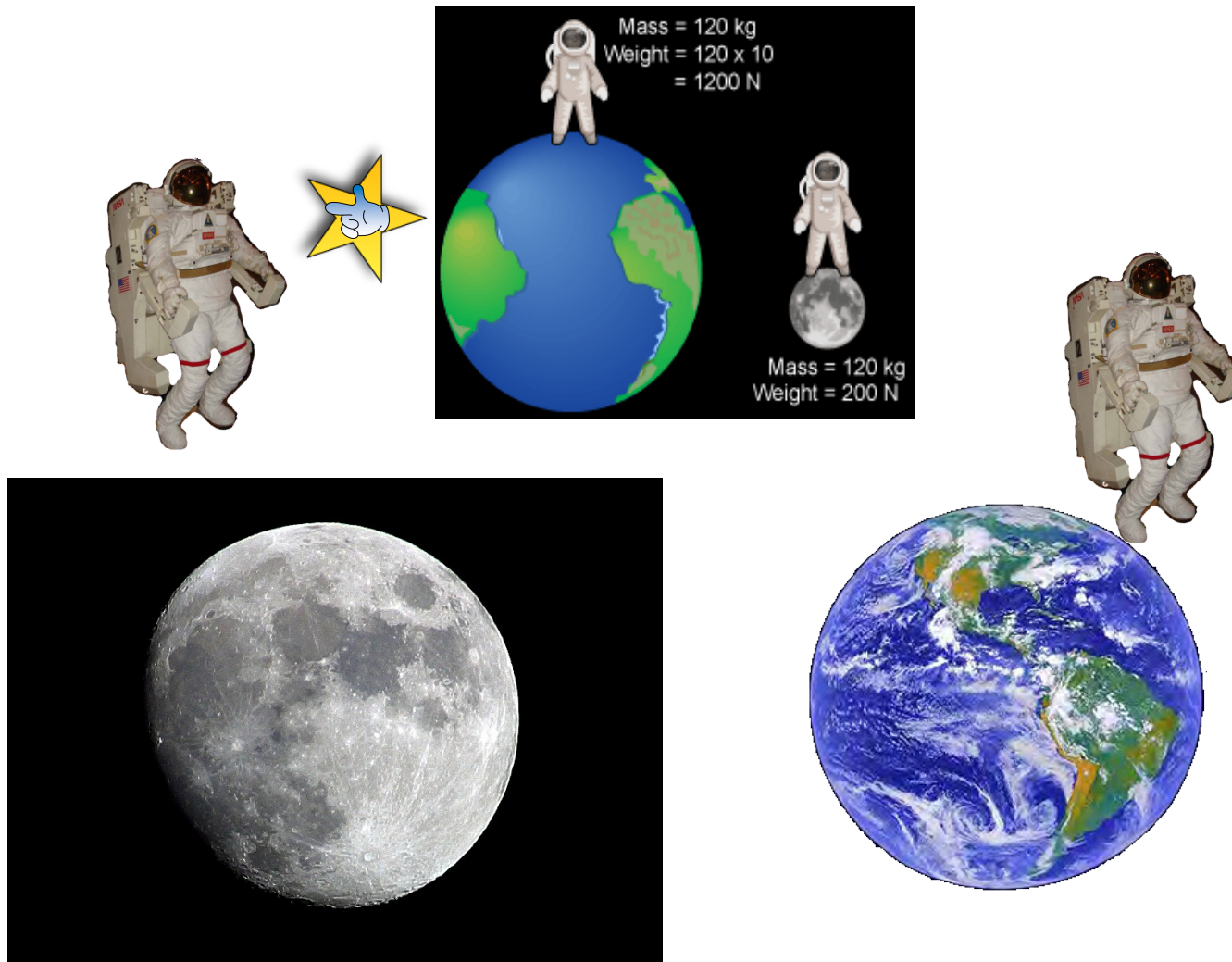


Mass and Weight

- **Mass** is the amount of matter in an object. it's easy to confuse mass with weight. Weight depends on the amount of matter in an object, however it also depends on the force of gravity.
- **Weight** is a measure of the pull of gravity on an object. While the mass of an object is always constant, the weight is not.



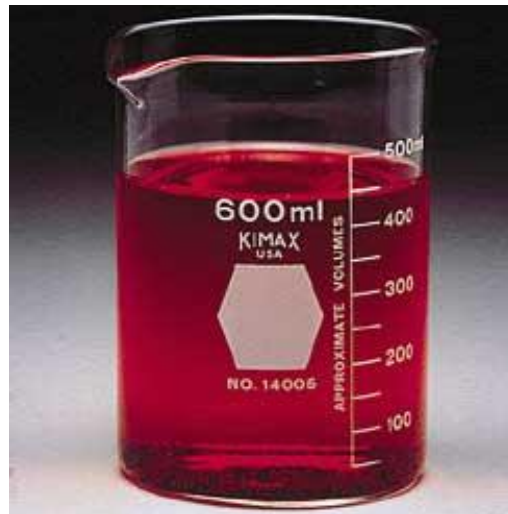
Will the Weight of the Astronaut be the same?



Volume

- Matter not only has mass but it also takes up space. **Volume** is the amount of space that an object takes up.
- The volume of a liquid can be measured in different ways. you can use a *graduated cylinder*.
- The volume of some solids can be calculated. Here is how:

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$



Mathematics in Science



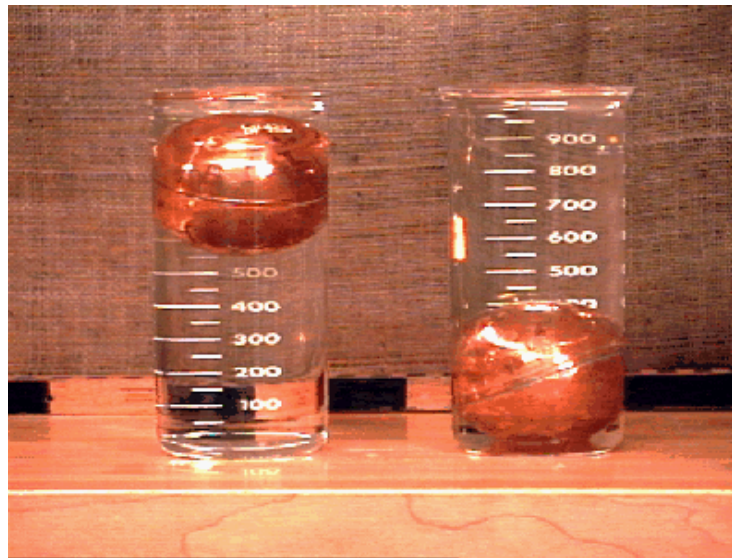
What is the volume of this box if A is 13 cm, B is 15 cm, and it can hold up to 2 toys standing, each of 20 cm high?

Density

- Mass and volume are two physical properties that can be measured .
- **Density** is the concentration of matter in an object. It is the amount in a certain volume.

$$\text{Density} = \text{Mass} / \text{Volume}$$

- Pure substances always have the same density when measured under the same condition. This property can be used for identification purposes.

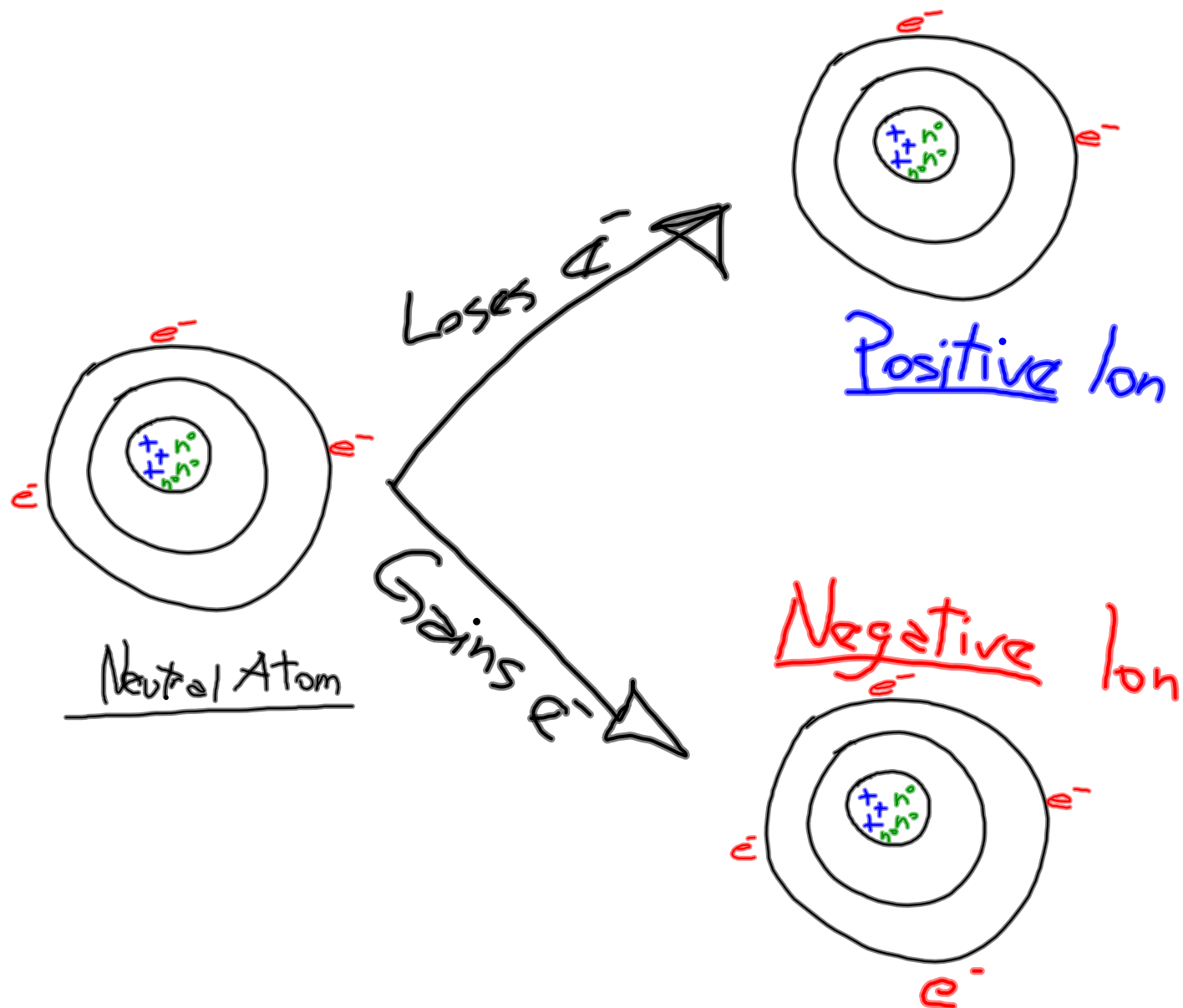


What is heavier: a Kilogram of feathers or a Kilogram of metal?



<http://bit.ly/3V4Rtx>

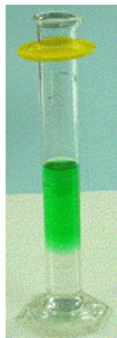
<http://bit.ly/rYDGu>



Mixtures and Solutions

- Most of the objects around us are not pure substances.
- A **mixture** is an interaction of two or more different kinds of matter, each of which keeps its own physical properties.
- Mixtures can be separated into the substances that make them up. The method used to separate a mixture depends on the physical properties of the substances in the mixture.
- The **solubility** of substances, or their ability to be dissolved, can be used to help identify them.

Floating Spheres



green
alcohol
water



green alcohol
oil spheres
water



C. Ophardt, c. 2003

How does matter
change from one
state to another?

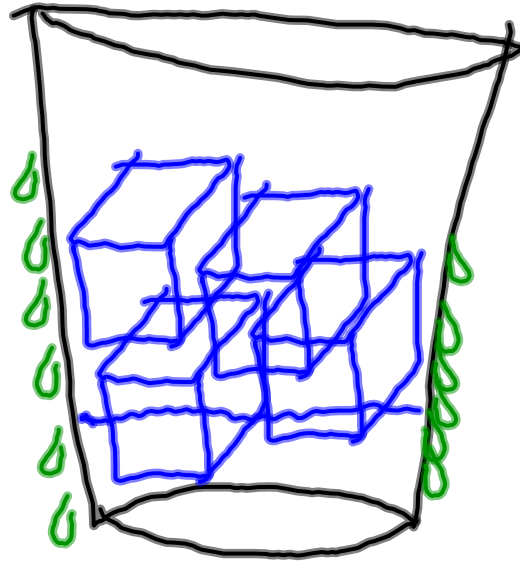
Three States of Matter

- Matter can exist in three states.
- A **solid** has a definite shape and a definite volume.
- A **liquid** has a definite volume but no definite shape.
- A **gas** does not have a definite shape or volume.

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Water and its states

<http://goo.gl/jBLL9>



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Properties of Water

<http://goo.gl/S8O2T>

Particles of Matter

- In a *solid* the particles are very close together, so there is very little space between them. This gives solids a definite shape and volume, but also keeps solids from moving too much.
- In a *liquid* the particles are not packed as tightly together so they move more freely than they do in a solid. This enables liquids to flow and take the shape of its container.
- In a gas particles are packed together the least. They are more free to move, so gas particles move the fastest.

Changes between States

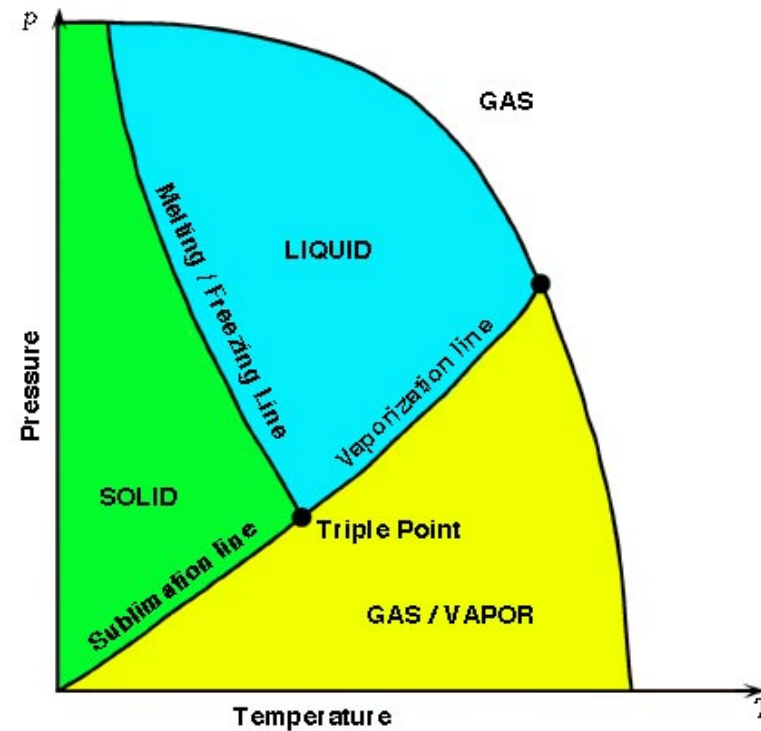
- All substances can change states.
- **Freezing** changes a substance from a liquid to a solid.
- **Melting** is a change in state from solid to a liquid.
- **Boiling** changes a substance from a liquid to a gas.
- Even when the temperature of a liquid has not yet reached its boiling point, some of the particles near the surface may be moving fast enough to evaporate.
- **Evaporation** occurs when particles escape from a nonboiling liquid and become a gas.
- **Condensation** changes a substance from a gas to a liquid.
- Particles can also escape from the surface of a solid and become a gas, in a process called **sublimation**.
- Changes in state are reversible.

Are they physical or chemical changes?

Changes of states imply only change in physical properties.

Melting and Boiling Points

- Not all freezing points are temperatures that you may think of as cold. Substances that are solids at room temperature have very high freezing points. Example: *The freezing point of copper is 1083°C .*
- The boiling point is the temperature at which a substance changes from a liquid to a gas is called its *boiling point*.
- Boiling points are not always temperatures you would consider to be hot. Example: *The boiling temperature of oxygen is -183°C .*



How does Matter react Chemically?

Physical and Chemical Changes

- Changes in which no new substances are formed are physical changes. All changes in state are physical changes.

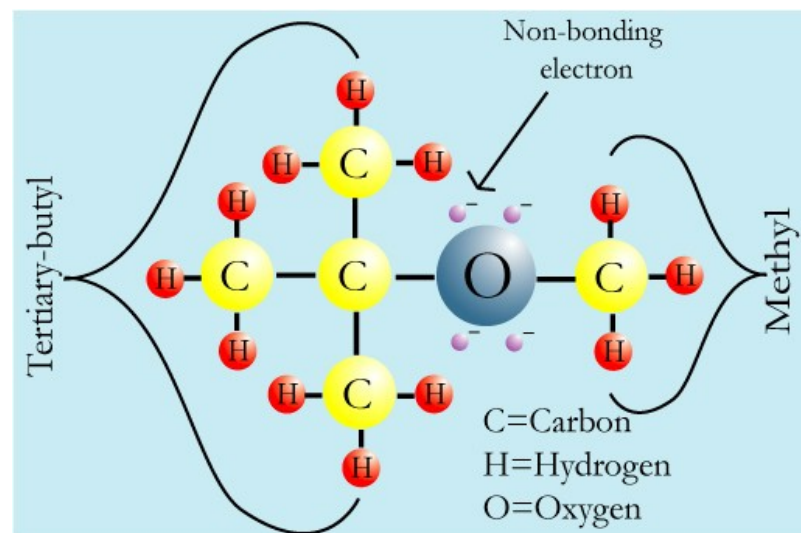
Examples of Physical Changes?

- Changes in which one or more new substances are formed are called chemical changes or *chemical reactions*.

Examples of Chemical Changes?

Using Physical and Chemical Properties

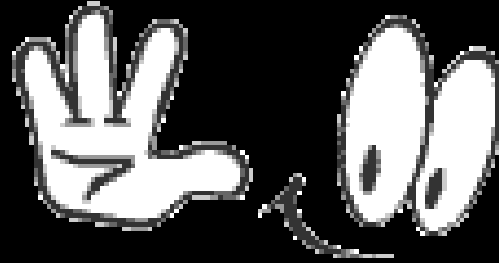
- Chemical reactions often forms products with properties that are different from those of the reactants.
- Chemical properties alone can sometimes be used to identify substances.



How is Matter present in Nature?



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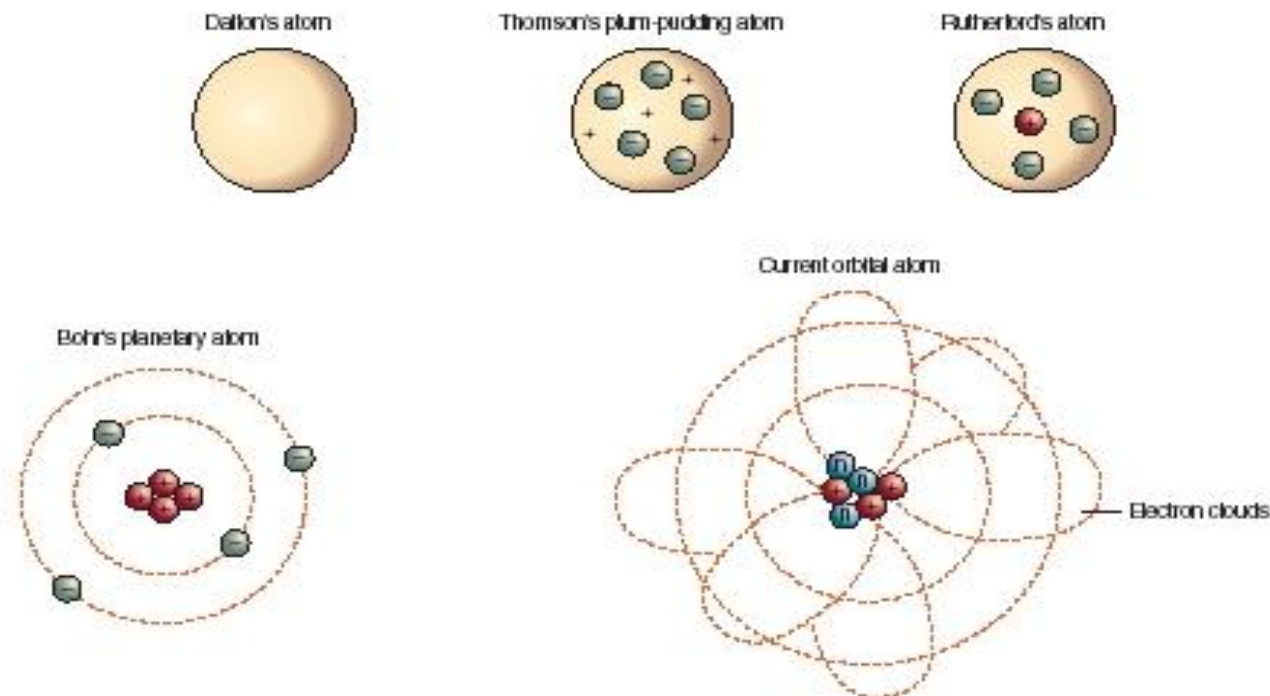


New knowledge beginning...

What are Atoms and Elements?

The Atomic Theory

- Democritus (400 BC) proposed that matter was not made of particles. This theory was accepted for 2000 years.
- By the early 1800s, John Dalton proposed an atomic theory of matter that was based on experimental evidence. His theory is that all matter is made up of tiny particles called *atoms*.



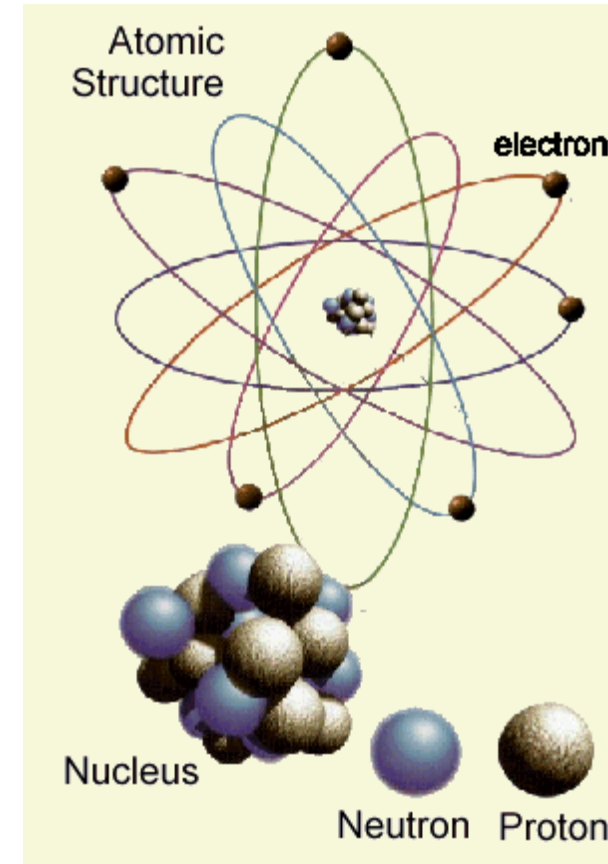
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Atomic Models

<http://goo.gl/0szUV>

The Structure of an Atom

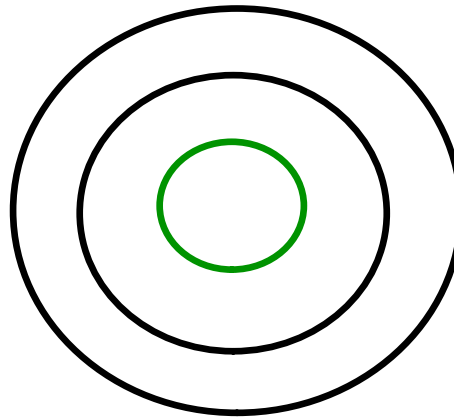
- Atoms are made up of even smaller particles called *subatomic particles*. The **nucleus** is the very tiny center of an atom.
- The nucleus is made up of protons and neutrons.
- A **proton** is a subatomic particle with a positive charge.
- A **neutron** is a subatomic particle with no charge. the rest of an atom is made up of electrons, which surround the nucleus.
- An **electron** is a subatomic particle with a negative charge.



Elements

- An ***element*** is a substance made up of only one kind of atom.
- An ***atom*** is the smallest unit of an element that has all the properties of that element.
- Each element has an ***atomic number***, which is the number of protons in one atom of that element. There are more than 115 elements; most of them that occur naturally, but some are made in the laboratory under artificial conditions.
- The atoms of most elements do not occur alone. Instead, they are linked together .
- Two or more atoms linked together form a ***molecule***.

$+$
 n°
 e^{-}



The Periodic Table

- Elements can be grouped together because they have similar properties.
- In 1869 Dmitri Mendeleev organized elements by their atomic masses, showing predictable patterns.
- It was found later that an order based on the number of protons in one atom of an element is better than one based on atomic mass.
- In the modern ***periodic table***, elements are arranged in order of atomic number.
- Elements with similar properties are in the same column, called ***group***. Elements from the same group have the same number of e^- in the outer energy levels of their atoms.
- The arrangement of e^- gives elements their chemical properties.

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<http://goo.gl/4luHu>

Metals

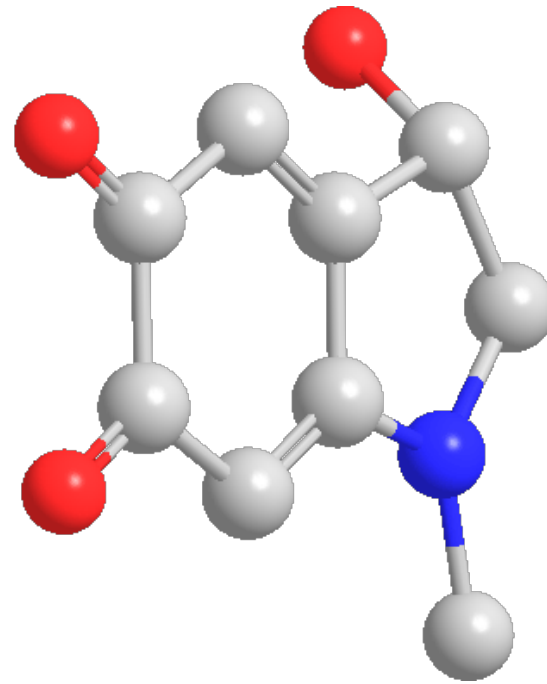
- Elements are classified by their properties.
About 25% of elements are *nonmetals*. The rest are metals.
- All metals except mercury are solid at room temperature.
- Metals have familiar properties: *luster* or shininess, *malleable* or hammered into thin sheets, *ductile* because they can be formed into wires, *good conductivity* (*electric and thermal*).



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The Structure of Metal

<http://goo.gl/tPfmE>



**What are
Compounds?**

Compounds

- A **compound** is a substance made of the atoms of two or more elements.
- A *chemical formula* shows which elements and how many atoms of each are in a compound.
- When atoms join to form a compound, they undergo a chemical change.
- The properties of the compound are different from those of the elements in it.
- Compounds can also react with each other. When compounds react, they change, and form new products.

Teacher's Notes

This class has been designed to cover the topics of *Matter, Atoms and Elements* from Monday, August 8th till Friday, August 12th.

For further knowledge about this topic:

- 1. Conduct a thorough search under the topic: *Matter, Atoms and Elements* on the Web, books and magazines.**
- 2. If findings are not specific, ask your teacher for suggestions.**

BACK

Objectives

- Understand the basic definition and properties of matter.
- Identify the basic atomic models.
- Understand the structure of atoms.
- Identify the main characteristics of chemical elements.
- Learn the chemical symbols of elements.
- Identify the position of elements in the periodic table.

Note: All, or most, of the objectives will be covered during class time, however the student must be responsible for those objectives not covered or concluded.

BACK

Vocabulary

- Nucleus:
- Proton:
- Electron:
- Valence:
- Nucleus:
- Particle:

***Note:** Most of the vocabulary words will be covered during class time, however the student must be responsible for those words not covered or concluded.*

BACK

Link and Learn

You can visit the following websites to improve your understanding on the present topic:

- <http://science-altair.wikispaces.com>
- <http://learningandscience.blogspot.com>

BACK

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Adjuntos

ChangesOfStateUS.notebook